

- (a) an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized to (i) one or more of the at least two electrodes, (ii) onto a substrate between the at least two electrodes or to (iii) said one or more of the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets;
- (b) an electric or electronic module for determining electric conductance between the at least two electrodes of each assay set; and
- (c) reagents comprising nucleation center-forming entities that deposit onto or bind to a complex formed between said recognition moiety and said target, and for growing a conductive substance from said deposited nucleation center-forming entities which yields a conductive bridge between at least two of the electrodes of a set, the formation of the complex itself or the deposition or binding of the nucleation center-forming entities themselves not yielding a conductive bridge, such bridge being formed only after growing said conductive substance.

10. (Twice Amended) A system for assaying one or more targets in a sample, comprising:

- (a) an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized to one or more of the at least two electrodes, immobilized on a substrate between the at least two electrodes or immobilized to said one or more of the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets;
- (b) an electric or electronic module for determining electric conductance between the at least two electrodes of each assay set; and

(c) reagents comprising monomers of a conductive polymer which deposit onto or bind to a complex formed between said recognition moiety and said target, and for growing a conductive polymer from deposited or bound monomers, such that upon polymerization of the monomers a conductive bridge between the at least two electrodes of a set is formed, the formation of a complex between the recognition moiety and the target itself or the deposition or binding of the monomers themselves to said complex not yielding a conductive bridge, such bridge being formed only after growing said conductive polymer.

24. (Twice Amended) A method for assaying one or more targets in a sample comprising:

(a) providing an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized to one or more of the at least two electrodes; on a substrate between the at least two electrodes or to said one or more if the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets;

(b) contacting said assay device with said sample under conditions permitting binding of targets to specific recognition moieties;

(c) contacting said device with a first reagent solutions comprising nucleation-center forming entities for depositing onto or binding to complexes formed between a target and a recognition moiety;

(d) connecting said device with a second reagent solution to grow a conductive metal substance from said nucleation center-forming entities for a time sufficient to yield a conductive bridge between said at least two electrodes, the formation of a complex between the recognition moiety and the target itself or the deposition or binding of nucleation center-forming entities to said complexes themselves not yielding said conductive bridge, such conductive bridge being formed only after growing said conductive metal substance;

(e) connecting said at least two electrodes to an electric or electronic module to measure conductance between said at least two electrodes; and

(f) determining conductance between said at least two electrodes, conductance above a threshold conductance indicating the presence of a respective target in the sample.

25. (Twice Amended) A method for assaying one or more targets in a sample, comprising:

(a) reacting the sample targets with a first reagent solution to bind comprising nucleation-center forming entities to deposit or bind said nucleation center-forming entities to said targets;

(b) providing an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized to (i) one or more of the at least two electrodes, (ii) on a substrate between the at least two electrodes or (iii) to said one or more of the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets;

(c) contacting said assay device with said sample under conditions permitting binding of targets to specific recognition moieties;

(d) contacting said device with a second reagent solution to grow a conductive metal substance from said nucleation center-forming entities for a time sufficient to yield a conductive bridge between said at least two electrodes, the formation of a complex between the recognition moiety and the target itself or the deposition or binding of nucleation center-forming entities to said complexes themselves not yielding said conductive bridge, such conductive bridge being formed only after growing said conductive metal substance;

(e) connecting said at least two electrodes to an electric or electronic module to measure conductance between said at least two electrodes; and

(f) determining conductance between said at least two electrodes, conductance above a threshold conductance indicating the presence of a respective target in the sample.

26. (Twice Amended) A method for assaying one or more targets in a sample, comprising:

(a) providing an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized either to (i) one or more of the at least two electrodes, (ii) on a substrate between the at least two electrodes or (iii) to said one or more of the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets;

(b) contacting said assay device with said sample under conditions permitting binding of targets to specific recognition moieties;

(c) contacting said device with a first reagent solution comprising monomers of a conductive polymer such that said monomers can bind to complexes formed between the targets and recognition moieties;

(d) treating said device such that said monomers will polymerize to form a conductive polymer, such that upon polymerization of the monomers a conductive bridge between the at least two electrodes of at least one set is formed, the formation of complexes between the recognition moieties and the targets themselves or the deposition or binding of the monomers to said complexes itself not yielding a conductive bridge, such bridge being formed only after growing said conductive polymer; and

(e) determining a conductance between said at least two electrodes, conductance above a threshold conductance indicating the presence of a respective target in the sample.

31. (Twice Amended) A kit for use in assaying one or more targets in a sample, comprising:

- (a) an assay device having one or more assay sets at least one for each target to be assayed; each of the assay sets comprising at least two electrodes and a recognition moiety immobilized (i) to one or more of the at least two electrodes, (ii) onto a substrate between the at least two electrodes or (iii) to said one or more of the at least two electrodes and onto said substrate; the recognition moiety being capable of specific binding to one of the targets; and
- (b) reagents comprising nucleation center-forming entities that deposit or bind to a complex formed between said recognition moiety and said target and for growing a conductive substance from said deposited or bound nucleation center-forming entities that yields a conductive bridge between at least two of the electrodes of a set, the formation of said complex itself or the deposition or binding of said nucleation center-forming entities to said complexes themselves not yielding said conductive bridge, such conductive bridge being formed only after growing said conductive substance.

35. (Twice Amended) An electronic device for determining one or more targets in a sample, comprising:

an integrated circuit comprising the first group of N_1 conductors and a second group of N_2 conductors, defining between them $N_1 \times N_2$ junctions, each such junction being formed with an electronic module comprising two electrodes, each one linked to or defined as an integral portion of one of the conductors, and comprises a diode or non-linear component permitting current flow through the electronic module only in the direction from the first group of conductors to the second group of conductors, whereby a current flowing between one conductor of the first group to one conductor of the second group of conductors defines a single junction point between them; each pair of electrodes forming part of an assay set, each assay set having a recognition moiety for binding a target, bound to at least one of the electrodes or to a non-conductive substance disposed between the electrodes, said target after binding to the recognition moiety to form a complex onto which nucleation center-forming